DOCUMENT RESUME

ED 039 036 24 PS 003 277

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TITLE	Behavioral Research Relevant to the Classroom.
INSTITUTION	Arizona Univ., Tucson. Arizona Center for Early Childhood Education.; National Lab. on Early Childhood Education.
SPONS AGENCY	Office of Education (DHEW), Washington, D.C. Div. of Educational Labs.
REPORT NO	NLECE-70706-A-FO-U-07
PUB DATE	Apr 70
CONTRACT	OEC-3-7-70706-3118
NOTE	56p.
EDRS PRICE	EDRS Price MF-$0.25 HC-$2.90
DESCRIPTORS	*Behavioral Science Research, *Behavior Change, Class Management, Classroom Research, Classroom Techniques, *Reinforcement, *Research Reviews (Publications), Social Reinforcement
IDENTIFIERS	Token Reinforcement

ABSTRACT

Behavioral research presents an analysis of the classroom in which sources of academic success or failure are sought in contingencies of reinforcement functioning in the child's learning environment. Motivation is analyzed in behavioral terms, and behavior principles are proposed as a powerful tool for teachers for the amelioration of behavior problems and the individualization of curriculums and experiences. Much of the research reported in this paper took place in natural environments of children and involved complex behaviors as dependent variables. Numerous investigations have shown that social reinforcement dispensed by adults functions as a positive reinforcer for many behaviors of children. Other studies indicate that token reinforcement, as part of well-designed programs, is effective in behavior modification and in promoting academic achievement. The studies reported deal with hyperactivity, behavioral and learning disabilities, remedial programs, and parent involvement. The behavioral analysis of complex academic behaviors, such as speech pathology and reading difficulties, has also shown promising results. The paper concludes with a discussion of methodological considerations, implications for education, and the value judgments involved in behavioral research. (Author/DR)

ED039036

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Document Number 70706-A-F0-U-07
Printed April, 1970

A research review in partial fulfillment of the preliminary examination of the Ph. D. program in Psychology.

Behavioral Research Relevant to the Classroom

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Occasional Paper

PS003277

The research or work reported herein was performed pursuant to a contract with the Office of Education, U. S. Department of Health, Education, and Welfare through the Arizona Center for Early Childhood Education, a component of the National Laboratory on Early Childhood Education, contract OEC-3-7-70706-3118.

Contractors undertaking such work under Government sponsorship are encouraged to express freely their professional judgment in the conduct of work. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

ACKNOWLEDGEMENTS

The preparation of this paper was supported by the Arizona Center for Early Childhood Education, Dr. Marie M. Hughes, Director. Many thanks are due to Dr. Ralph Wetzel, Dr. Wayne Carroll, and Dr. Vincent Tempone of the University of Arizona, Department of Psychology, who read the manuscript and made many helpful suggestions.

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BEHAVIORAL RESEARCH RELEVANT TO THE CLASSROOM[1]

Marian Martin, University of Arizona

Introduction

Current dissatisfaction with educational institutions is widespread. To some extent, the prevailing problems of the society exist within educational institutions as well, and these require solution on the larger social scene. However, a set of problems does exist that seems to be the particular product and responsibility of the educational establishment, and the failure to find solutions is a growing source of concern.

A first component of this set of problems is a failure of the educational environment to impart to large numbers of children, such as those with "learning disabilities" and the children of the poor, the academic skills demanded by our technological society as a basis for social and and economic success. A second component is the increasing difficulty of maintaining proper deportment, sufficient motivation, and a positive attitude toward school and learning in many of the children attending. These problems are measured in lack of progress on standard achievement tests, diminishing I. Q. scores with increasing years of school attendance, classroom disruption, "underachievement," and dropping out.

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[1]A research review in partial fulfillment of the preliminary examination of the Ph. D. program in Psychology.

Traditional Approach

Teachers and educational administrators know of the need for innovative change in the schools. However, the search for improvement has primarily been focused on providing additional buildings, better equipment, new curricula, and better teaching staffs. What has not changed, and indeed remains extremely resistant to change, is the view that children will learn in school if their capabilities and intrinsic motivation are adequate, and if these capacities are allowed to function in the classroom environment.

Research

Sears and Hilgard (1964) cite a number of studies in which personality traits of teachers are assessed for their effect on children possessing particular personality traits. For example, well-integrated teachers were found effective with opposing or wavering children, while fearful teachers were found less effective, except with high striving children (Heil, Powell, and Feiffer, 1960). In addition, interactions were found between teacher personality, and teaching method. Sears and Hilgard (1964) also state that the relationship between economic class membership and school success reflects a measure of children's achievement motivation, usually not well established in the children of the poor. Such research suggests that, should the schools be failing,

this is a function of the imperfection of mortals, especially of teachers, of children, and of the children's parents.

The Behavioral Approach

In a collection of papers written over the past fifteen years, Skinner (1968) challenges the traditional orientation and asserts that behavior theory has a great deal to offer to education:

> Teaching may be defined as an arrangement of contingencies of reinforcement under which behavior changes. Relevant contingencies can be most successfully analyzed in studying the behavior of one student at a time under carefully controlled conditions. Few educators are aware of the extent to which human behavior is being examined in arrangements of this sort, but a true technology of teaching is imminent. It is beginning to suggest alternatives to the average practices that have caused so much trouble (p. 93).

Skinner's contentions are receiving growing support from behavioral researchers. Sources of academic failure are increasingly sought in the contingencies of reinforcement functioning in the learning environments of children (Bijou, 1963). Motivation is analyzed in behavioral terms, and systematic application of behavior principles is proposed as a powerful tool for teachers (Whelan & Norris, 1965). Homme (1967), referring to social and academic learning by children, is positive and enthusiastic:

> By taking seriously the fundamental laws of behavior already well established, we can promote

> great changes for the better in our society (p. 1) . . . There is no problem getting behavior one wants emitted if one is willing to arrange for a payoff for an approximation to it at first (p. 14) . . . The first job is to find a reinforcer; the second is to set up a small initial contract and pay off. It has been our experience that, if these two conditions are met, contingency management always works (p. 16) . . .

The responses of some educators are less positive and enthusiastic. For example, Maehr (1968) accuses behavioral researchers of ignoring curiosity and risk-taking as sources of motivation for learning: "Potential failure is probably an important ingredient of the learning situation, since it makes success meaningful (p. 25)." This statement offers a good description of aversive control, which Skinner (1968) considers a highly inefficient system of motivation. Maehr concludes that, "a cognitive theory of motivation (is needed) in order to handle complex human learning. Simple reinforcement principles are just too simple (p. 25)." This paper will review the rapidly expanding body of research upon which these claims, both optimistic and pessimistic, are based.

Behavior Therapy: Some Conclusions

Several of the conclusions derived from behavior modification research in clinical settings have special relevance for research and

practice in the classroom, and for the work of school psychologists. The successful use of behavior therapy techniques with adult neurotics led to a suggestion by Rachman (1962) that similar techniques should have therapeutic possibilities for the behavioral disorders of childhood. Ferster (1961) had already published work using positive reinforcement to develop performances of hopsitalized autistic children. The large number of behavior therapy case studies and research investigations with children that followed have been reviewed by Gelfand and Hartmann (1968) and by Leff (1968).

As both reviews point out, an assumption of behavior therapy has been that whatever the deviant behavior may be, it was established through a learning process, and it can be eliminated as a result of further learning. Similarly, behavior deficiencies can be remediated by learning of appropriate new behaviors, or the elaboration of poorly developed skills.

Within the clinical setting, behavior modification with children's problems, ranging from obstinate disobedience to autistic self-destruction, has shown that these assumptions can be translated into an effective and powerful methodology. The locus of intervention throughout is the modification of discriminative stimuli and contingencies of reinforcement in the environment, thought to be in present or potential control of the target behaviors.

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The usual "behavior profile" presented by the deviant child includes multiple problem behaviors (Patterson and Brodsky, 1966). A behavioral analysis of these problems will result in a multiple strategy for remediation. For example, new responses may have to be conditioned to stimuli presently eliciting anxiety. The deviant responses to be extinguished must be replaced by incompatible appropriate responses, which in turn must be developed or strengthened. The adaptive behavioral repertoire often needs elaboration, and positive reinforcers may have to be established. The contingencies of reinforcement provided by parents, or peers, must be programmed and maintained accordingly.

Behavior therapists have worked increasingly at the task of reprogramming the natural social environment of the child, and less and less with the child and his peculiar deviancies. The vague hope for generalization of therapeutic gains into the natural environment, a generalization that frequently failed to occur, was replaced by the development of a social environmental technology in which people occupying important roles in the life of the child became the primary mediators of behavioral change (Patterson & Brodsky, 1966; Gelfand & Hartmann, 1968; Leff, 1968).

Hawkins, Peterson, Schweid, and Bijou (1966) report a behavior therapy program carried out entirely in the home, with the mother in the therapeutic role, in which multiple problem behaviors, including aggression, disruptive disobedience, hyperactive demands for attention, and tantrums,

were successfully treated. Elimination of severe scratching (Allen & Harris, 1966), and of psychogenic seizures (Gardner, 1967), was effected by counseling with the parents only, training them in the use of reinforcement techniques and contingency management. Behavior therapy by a teacher in a kindergarten setting was successful in establishing speech in a selectively mute child, after direct intervention efforts by a speech therapist, a pediatrician, and a psychiatrist, had failed over a two-year period (Brison, 1966).

An extensive discussion of the essential role of the natural social environment of children in affecting and maintaining therapeutic behavior change is presented in a recent book by Tharp and Wetzel (1969).

The relevance of behavior therapy for school psychology has been discussed by Woody (1966). While he concludes "that many of the principles and techniques of behavior therapy are applicable in school psychology (p. 11)." Woody cautions that school psychologists presently are not trained in the use of these principles or techniques. In addition to the need for training, the "reserved acceptance" of educational personnel must be overcome, possibly by involving parents on their children's behalf. Woody concludes, "The evidence supports that rewards and recognition can successfully modify behavior in an educational setting. In view of established classroom procedures, this usage will undoubtedly be difficult and perhaps temporarily impossible to execute in a regular classroom (p. 11) . . ." However, in spite of "reserved acceptance," the application of behavior

therapy principles and its research methodology, in the regular classroom, has begun.

Contingent Social Reinforcement

The investigations reported in this section studied various behaviors of children in preschool and classroom environments. The principal independent variable in these studies was adult-dispensed contingent social reinforcement.

The laboratory study of the effects of social reinforcement on children's behavior has presented numerous methodological difficulties (Parton & Ross, 1965). Most of these difficulties seem to arise because children are extremely good discriminators of social stimuli, and such stimuli exert a strong effect on their behavior, even at a young age. Fully automated procedures have been proposed as essential to a careful analysis. For example, Baer (1962) employed a talking puppet to deliver standardized social reinforcement contingent on bar press responses of children.

More informally arranged experiments, using human dispensers of social stimuli, are much harder to analyze. However, the effects demonstrated are often very dramatic, as for example in the conditioning of vocalization in three month old infants, by presentation of contingent adult social reinforcement (Rheingold, Gewirtz & Ross, 1959).

Preschool Studies

Harris, Wolf and Baer (1964) review a series of field studies in which problem behaviors of preschool children, such as regressed crawling, crying and whining, isolate play, and excess passivity, were shown to be under the control of adult dispensed social stimuli.

The research strategy was similar in all of these investigations. After baseline observations, teacher attention was systematically withdrawn from the problem behavior, and made contingent on an incompatible, desired behavior. When conditioning had been demonstrated, the contingency was reversed, with teacher attention contingent on the problem behavior only. After recovery of a high rate of the problem behavior, teacher attention was again made contingent on desired behaviors, and the problem behaviors decreased in frequency or were eliminated. The authors concluded that "the findings in each case clearly indicated that for these children, adult attention was a strong positive reinforcer (Harris, et. al., 1964, p. 16)."

The positively reinforcing effects of adult attention have been demonstrated in the elimination of aggressive behavior, with an attendant rise in cooperative play, of preschool children (Brown & Elliott, 1963), and in the conditioning of manipulative skills, climbing, and social play in brain injured children (Hall & Broden, 1967). Parents and teachers served as reinforcing agents in these studies.

Amount of teacher attention. Similar results were reported by Hart, Reynolds, Baer, Brawley and Harris (1968) in establishing and maintaining cooperative play by a preschool child. After baseline, teachers dispensed abundant, but noncontingent, positive attention, during about 80 percent of each observation period. Subsequently, the same amount of positive attention was dispensed contingent on cooperative play, which initially required considerable shaping. These conditions were then repeated. Cooperative play, which occurred in about 4 percent of baseline observation intervals, rose to almost 40 percent under the condition of contigent teacher attention, and remained at this level after the amount of attention was reduced to 20 percent. Abundant noncontingent positive attention failed to increase cooperative play, or to maintain it, once it had been established.

Cueing by observers. A final study in the preschool setting has relevance for classroom readiness (Allen, Henke, Harris, Baer & Reynolds, 1967). The subject was a four and a half year old boy who, though possessing well-developed social, intellectual, and motor skills, was unable to remain with a given task for more than a minute at a time. By systematic use of adult social reinforcement, the child's activity changes were cut by more than half, and he eventually remained with one activity for twenty minutes or more.

In this study, teachers were signaled by observers, with a flashlight, whenever the boy attended to any given task or activity

for one, and later two or more minutes. Other social behaviors of this child, including proximity to peers, talking with peers, and cooperative play, recorded throughout the study, remained constant over treatment conditions.

Classroom Studies

Perhaps the first report of behavior modification by manipulation of social reinforcement contingencies in a classroom setting was that of Zimmerman and Zimmerman (1962). Inappropriate and disruptive behaviors of two hospitalized emotionally disturbed boys were eliminated by systematically giving teacher attention only when appropriate behaviors were being performed.

More recently, a series of investigations in normal classrooms have begun an analysis of the effects of teacher attention on children's behavior. Becker, Madsen, Arnold and Thomas (1967) conducted a seminar for five volunteer teachers on the use of operant principles, specifically instructing them to (a) make explicit rules, (b) ignore undesired behaviors, unless a child was in danger of being hurt, and (c) to praise all desired behaviors. The object was to change the behavior of the teachers toward the whole class. Two children in each class were chose as "barometers" to indicate the effectiveness of the changes. The ten subjects all regularly engaged in disruptive behaviors, including restless moving about, tantrums, aggression, talking or blurting out, etc.

Teachers and subjects were observed daily. The rate of undesired behaviors for the group dropped significantly from 62 percent during baseline, to 29 percent. However, the technique was more successful with some teachers, and children, than with others.

Hall, Lund and Jackson (1968) increased the amount of study behavior by six children in classrooms in a Kansas City poverty area school. A cueing procedure was used to assure teacher attention contingent only on study behavior, with consistent ignoring of undesired behaviors. An observer held up small squares of colored paper when the target child was studying, and the teacher reinforced the child with attention (coming into proximity, talking to the child, patting his shoulder) whenever the signal was given. Baseline was followed by conditioning, reversal, reconditioning, and then post-checks several weeks later.

The work of Becker, et. al. (1967) and Hall, et. al. (1968) indicates that contingent teacher attention in the classroom can do much to eliminate behaviors which interfere with learning, and to increase desirable behaviors, without major changes in the school or home, and without any other form of therapy for the child.

Classroom management. Madsen, Becker and Thomas (1968) report one in a series of studies "aimed at demonstrating what the teacher can do to achieve a 'happier,' and more effective classroom, through the systematic use of learning principles (p. 139)." Target behaviors of three children

with existing behavior problems were recorded in two classes. Three conditions of teacher behavior were then introduced: (a) rules for good behavior were posted and reviewed several times daily, (b) teachers were instructed to ignore all inappropriate behaviors, unless a child was in danger of being hurt, and (c) teachers were to use copious praise for approximations to, and performance of, all appropriate behaviors. Neither rules nor ignoring made any difference in the children's behavior, but inappropriate behavior decreased significantly during approval conditions.

The failure to find a lasting effect of rules alone has also been reported by Allyon and Azrin (1964). In the Madsen, et. al. (1968) work, however, an experimenter bias may have been introduced, since teachers were told not to expect dramatic changes with rules alone as "we all know that knowing the prohibitions does not always keep people from 'sin' (p. 143)." Rules and ignoring were continued during approval conditions, and an uncontrolled teacher behavior, academic recognition, was found to vary over conditions also. Both teachers had difficulty in withholding attention consistently from undesired behaviors. The behavior of a teacher's aide was also thought to have influenced the results.

Thomas, Becker and Armstrong (1968) manipulated the approval and disapproval dispensed by a teacher to 28 middle primary upper-middle class children. Disruptive behavior by the children, at 8.7 percent during

baseline, rose to 25.5 percent when approval was withdrawn. When teacher disapproval was tripled, disruptive behavior rose to 31.2 percent, falling to 13.2 percent when approval was reintroduced. Appropriate behavior rose during approval conditions, and fell when approval was withdrawn. The changes described occurred in about 75 percent of the children, with no change in about 5 percent, and 20 percent showing changes opposite to those of the majority.

Conclusions

Although initially difficult to accept, the research on effects of adult social reinforcement leads to the same conclusions as does behavior therapy research: "Attention in almost any form may maintain deviant behaviors (Becker, et. al., 1967, p. 287)." Also, systematic use of adult attention can establish and maintain appropriate and desirable behaviors, and this can be done without disruption of other desirable behaviors already in the child's repertoire (Allen, et. al., 1967). As pointed out by Harris, et. al. (1964), however, "Adult attention must be or become positively reinforcing to a child before it can be successfully used to help him achieve more desirably effective behaviors (p. 16)."

If the desired behavior does not exist at some frequency, however low, in the child's repertoire, extensive shaping procedures may be a prerequisite. Wiesen, Hartley, Richardson and Roske (1967) recorded

only 20 seconds of cooperative play during a five day observation of a group of institutionalized retarded five to nine year old children. The children were taught, initially by physical prompts, to give M & M candies to one another, and were then reinforced with an M & M for themselves. Response criteria were changed toward those of cooperative play over a two week period. The authors concluded that positive reinforcement could be useful in developing socialization in retarded children, skills which might then be increased or maintained by contingent adult attention.

The Madsen, et. al. (1968) and Thomas, et. al. (1968) studies lack clarity in both procedures and results. However, these studies and other work in preschool and classroom settings, indicate that social reinforcers dispensed by teachers are powerful variables in controlling children's behavior. When social reinforcement from the teacher is low, peer reinforcement may gain in importance (Thomas, et. al., 1968). The behavior of children in classrooms may be much more a function of environmental events, such as contingencies of teacher attention, than previously recognized, and much improvement may be possible by increasing the attention of teachers to these contingencies.

Token Reinforcement

Some form of token reinforcement has been employed as an independent variable in numerous investigations of children's social and academic behaviors in classroom settings. The demonstration by Ferster

(1964) that chimpanzees could learn binary arithmetic with carefully programmed stimuli and a token reinforcement system, seemed to imply that, with token reinforcement techniques, one ought to be able to teach just about anything to anyone. Indeed, one important use of tokens has been to motivate some children to work on programmed materials. Token reinforcement systems have proven to be a powerful, if complex, tool for behavior modification and for prompting academic achievement.

Social and Academic Learning of Retardates

Carefully structured token reinforcement programs administered by teachers and caretakers in institutional cottage and classroom settings have been successful in the establishment and elaboration of social, self-help, and academic repertoires of retarded children (Girardeau & Spradlin, 1964; Birnbrauer & Lawler, 1964; Birnbrauer, Wolf, Kidder & Tague, 1965). Birnbrauer and his associates used token reinforcement to maintain performance on individually programmed academic materials, as well as to shape and strengthen social and deportment behaviors.

The very extensive literature on the use of tokens, as well as other operant technologies, with retarded children, has been reviewed by Watson (1967).

Hyperactivity and Attention

Although some children with "poor attention" spend their time daydreaming, dawdling, or staring out of windows, most disturbances

associated with poor attention include behaviors usually labeled hyperactivity or overactivity. Remediation involves extinction of the hyperactive behaviors and concurrent conditioning of incompatible "attending" behaviors.

Several studies report the use of tokens to condition attentional responses, including positive interaction with toys (Doubros & Daniels, 1966), and lever pressing (Martin & Powers, 1967), by institutionalized retarded children, with simultaneous extinction of disriptive or hyperactive behaviors. Ability to overcome the hyperactivity traditionally considered a trait of retarded children is also evident in a report by Sloane and Harper (1965) of task persistence by a thirteen year old retarded boy, who worked steadily at a match to sample apparatus, with token reinforcement, during a Richter Scale 7 earthquake. "The results do pose interesting questions about the common belief that distractibility or poor attending behavior account for much of the learning deficit in human retardates (Sloane & Harper, 1965, p. 426)."

Hill and Buckley (1968) report individual conditioning sessions with a highly distractible and disruptive fourth grade boy, in which work on programmed material was reinforced by points, later traded for models. When thirty minutes of attending were maintained in individual sessions, the boy was reintegrated into a regular classroom, where the teacher administered points and social reinforcement on a VI:30 min schedule.

Orienting responses of five boys in a special classroom were increased by delivering contingent light flashes, discriminative for later dispensing of M & M candies, or in a subsequent phase, for the dispensing of social reinforcement by the teacher (Quay, Sprague, Wherry & McQueen, 1967). As in baseline, listening to a story failed by itself to sustain orienting behavior during extinction.

Behavioral and Learning Disabilities

Children assigned to learning disabilities or adjustment classrooms have failed to come under the control of social or other naturally occurring reinforcement in the school environment. Often this is true of their home environment as well. A well-planned token economy may be effective in providing the behavior changes necessary for better adjustment and reintegration into regular classrooms.

Although special classrooms may offer sufficient staff and resources to establish elaborate token economies, these alone are not always sufficient; the transition from the token system to natural reinforcement must be carefully programmed. Stars backed up by class "parties" were used to reinforce an eight year old girl for refraining from tantrum behavior in the classroom (Carlson, Arnold, Becker & Madsen, 1968). During tantrums, the child was held in her chair at the back of the room, and peers were reinforced with candy for not attending to her. Tantrums were eliminated, and adjustment improved. Unfortunately, the girl was

transferred to another school, where tantrums reappeared, and a course of tranquilizing medication and assignment to a classroom for the emotionally disturbed was adopted.

Special classroom programs. Successful programs of behavior modification, using tokens, for severely emotionally disturbed kindergarten and primary grade children have been reported by Valett, 1966; Hewett, 1967; Hotchkiss, 1967; O'Leary & Becker, 1967; Rabb & Hewett, 1967; and Dyer, 1968. Valett (1966) considered the following essential for successful management of such programs: (a) individual programming of well-organized learning materials, (b) immediate reinforcement via tokens, (c) social reinforcement, (d) primary reinforcement, if needed, and (e) clearly spelling out the system to the children. In Valett's program, children earned tokens for school attendance, getting ready to work, working, correct work, good behavior, and helping others. Tokens earned stars, which were traded for food, award parties, trinkets from a "Gold Star Surprise Box," membership in a Citizen's Council with attendant privileges, and finally, a citizen's Honor award, such as a bowling party or luncheon.

Improved academic performance by institutionalized delinquent boys working for tokens backed up by food, canteen items, and privileges have been reported by Tyler & Brown (1968), and by Cohen, Filipczak & Bis (1965). A system of token reinforcement was found

ineffective in controlling the behavior of all but a few children in an experimental classroom for severely deviant adolescents (Martin, Burkholder, Rosenthal, Tharp & Thorne, 1967). A phase system, in which privileges, status, and newly developed reinforcers were added, while established reinforcers were taken off the token system, was effective in shaping and maintaining appropriate behaviors and in eventual reintegration of the subjects into public school classrooms. Extensive training of the families and liaison with public school personnel were also found essential.

Preferred activities as backup reinforcers. Public school reintegration was also achieved for adolescents with severe learning disabilities, by Nolen, Kunzelman & Haring (1967). In this program, tokens were points exchangeable only for naturally occurring reinforcers such as play periods, typing, woodworking, games, and science activities.

The use of preferred activities to back up tokens, an application of the Premack principle (Premack, 1959), has been employed extensively by Homme and his associates (Homme, C'deBaca, Devine, Steinhorst & Rickert, 1963; Addison & Homme, 1966; Homme, 1967). The contingency management system used in these studies made a specified period of time on a reinforcing behavior contingent on a specified amount of task behavior. A "Reinforcing Event Menu" listed numerous activities found or

thought to be high probability behaviors for the children. The menu recorded reinforcing events and prompted selection by the child. Sustained performance on academic tasks, and rapid acquisition of academic skills, such as reading, were obtained in preschool children.

Martin (1968) used food, trinkets, and preferred activities such as games, art projects, and classroom jobs, to back up tokens in a first-second grade classroom of poverty area minority group children. Increasing rates of academic performance, and achievement significantly better than that of a previous group in the same school, were demonstrated. McKenzie, Clark, Wolf, Kothera & Benson (1968) also used preferred activities as token backups in a learning disabilities class. In addition, tokens were backed by grades, which in turn served as tokens backed up at home with weekly allowance payments.

Remedial Programs

Repeated academic failure and increasing social maladjustment are often closely associated. In what they call a program of "cognitive behavior modification," Staats, Minke, Goodwin and Landeen (1967), trained hosewives and high school seniors to use tokens in teaching remedial reading materials to eighteen seventh and eighth grade retarded readers. Increasing reading rates, and scores on some of the tests administered significantly higher than those of matched controls, were shown.

Staats and Butterfield (1965) used tokens to develop reading behavior in an adolescent delinquent boy. During the 4-1/2 month program, the boy made greater gains in tested reading achievement than during his previous eight years of school attendance. Alleviation of reading difficulties in an 11 year old boy of normal intelligence was reported by McKerracher (1967). The boy's correct reading response lit small light bulbs, tokens for candy reinforcement. A buzzer after incorrect responses was presented in the early stages of training. Signs of anxiety, including stammering during oral reading, diminished over sessions.

Reading acquisition was facilitated in a boy experiencing little progress and considerable anxiety in the reading program of his first grade classroom (Whitlock, 1966). Tokens, backed up by various activities, were used to shape a reading repertoire, beginning with unit responses and progressing to preprimer and primer materials, with successful reintegration of the boy into the classroom program. Subsequently, reading responses of an eight year old girl were reinforced in a remedial tutorial situation by increments on a counter mounted in a clown's mouth (Whitlock,& Bushell, 1967). Counter increments alone proved ineffective in sustaining reading responses, but when increments were treated as tokens, with backup reinforcers provided, reading responses were maintained at stable rates.

Points, entered on wall charts and backed up by grades, letters of commendation, and excused class absences, proved effective in significantly increasing appropriate deportment and work behaviors of students in two high school remedial reading classes (Martin, Schwyhart & Wetzel, 1967). Behaviors of students in a third token classroom were similar to those of control classes until the introduction of drive-in movie passes as additional backups, when the desired behaviors rose sharply. There was no difference in tested reading achievement gains between token and control classes, however. Breiling (personal communication) is conducting remedial reading classes in a parochial school, using tokens backed by food and canteen items. The grades of a majority of the children enrolled have shown improvement.

After school programs. Clark, Lachowicz and Wolf (1968) set up matched groups of five Neighborhood Youth Corps enrolees, one group to work on the job, and the other to work half days on academic tasks for tokens backed up by their regular pay. The academic work group gained a median of 1.3 years in tested achievement over 44 working days, as compared to a 0.2 year gain by the control group.

Superior achievement was also shown by fifteen fifth and sixth grade poverty area children enrolled in an after-school remedial program (Wolf, Giles & Hall, 1968). All subjects were at least two years retarded in reading achievement. Individualized materials were worked on by the

children, earning tokens exchangeable for food, field trips, store items, cash, and shopping trips. By manipulating token payoffs, increased rates of work and work in less preferred academic areas were obtained, results also found by Clark, et. al. (1968). Students could also earn the right to tutor, and to get extra work for themselves. Homework from the school was done in the remedial classroom for tokens, and school grades were also reinforced. All of the subjects gained in tested achievement and grade point averages, significantly more than the matched controls.

Parent Involvement

Parents are very powerful reinforcing agents for their children. Several token programs have tried to arrange for parental reinforcement to support program goals. Letters and notes reporting good classroom behavior were used by Martin, et. al. (1967), Martin (1968), and Breiling (personal communication). Tokens were given in class to children for the performance of various behaviors at home, such as reading books to their parents (Martin, 1968). In Breiling's program, parents payed for backup reinforcers earned in school. Clark, et. al. (1968) trained parents in how to back up grades with allowances. Extensive parent training was carried out by a staff of behavioral analysts to extend program gains into the natural environment (Martin, et. al., 1968).

Conclusions

Tokens have both discriminative and reinforcing functions. Since they are, at least initially, dispensed immediately upon the performance of a desired behavior, they can help teach a child exactly what the desired behavior is. Tokens also minimize the interruption of ongoing response sequences, which may occur with consumable or manipulable reinforcers. Further, tokens provide additional and effective motivation, in those instances where social reinforcement or other naturally occurring haphazardly scheduled reinforcers are insufficient to control behavior. Using tokens, schedules can be arranged so that long periods of responding, sometimes crucial to skill development, can be maintained in children without fatigue or negative reactions.

Token systems require planning, administration, bookkeeping, assessment, and a suitable, well-organized academic program. In addition, the successful use of tokens appears to depend heavily on the application of other reinforcement principles. Kuypers, Becker, and O'Leary (1968) have analyzed the differences between a marginally effective token system, and a previously employed similar system of high effectiveness (O'Leary & Becker, 1967). The differences included (a) an absolute standard for reinforceable responses was adopted, rather than a shaping procedure, (b) the teacher continued to attend to unwanted behaviors, (c) the teacher was not trained in the use of reinforcement principles, (d) the teacher did not object to some behaviors scored as deviant,

(e) the behavior of some observers was disruptive, and (f) the study took too much of the teacher's time. The reduction in the children's disruptive behaviors was statistically significant, but small, and involved only some of the children. The teacher found the project of little value, and at least parts of it aversive, and she refused to continue with the research.

Tokens, when successful, function in an environment of other discriminative and reinforcing stimuli, many of which may be more powerful than the tokens and their backups. These observations do not of course diminish the demonstrated efficacy of token systems as part of well-designed programs.

Analysis of Complex Academic Behaviors

Behavioral research on complex academic behaviors has focused primarily on speech and on reading. "Treating speech as behavior, in and of itself, and not as a symbolic representation of underlying meaning, has demonstrated lawful relationships which fit the general theoretical framework of learning theory (Salzinger, Portnoy, Eckman, Bacon, Deutsch & Zubin, 1962, p. 692)." An extensive discussion of the application of learning theory principles to language, including speech and reading behaviors, can be found in Staats (1968).

Speech Pathology

Reinforcement principles have been widely applied to the study and remediation of pathological speech behaviors, such as nonfluency and

and stuttering (Shames & Sherrick, 1965; Holland, 1967). Behavior modification programs involving changes in response rates, establishment of new responses, establishment of stimulus control over responding, and the elaboration of existing repertoires, are described by Brookshire (1967).

McReynolds (1966) used operant conditioning to establish responding to speech sounds in order to evaluate auditory perceptual functioning in aphasic children. Correct responses gained a green light plus candy or a trinket. The children were first trained on a single sound, then on another easily discriminable sound, and then tested on random series of both sounds, in a two lever task. The methodology provided a sensitive assessment of specific problems. For example, the aphasic children had trouble learning embedded sounds, but not sounds in isolation. The greatest difference between the aphasics and a group of normal children was in their learning rates. Given a sufficient number of trials, accomplished through good reinforcement control, the aphasic children were able to master all of the discriminations provided. McReynolds speculated that aphasic children may have learned to ignore language, but he concludes that they can learn to attend and listen to speech sounds.

Establishment of continuous speech has been investigated in non-speaking retarded children (Cook & Adams, 1966), in autistic children (Hewett, 1965; Lovaas, Berberich, Perloff & Schaeffer, 1966), and in

cases of selective mutism (Brison, 1966; Reid, Hawkins, Keutzer, McNeal, Phelps, Reid & Mees, 1967) with reinforcement techniques. The successful establishment of language with operant procedures has been questioned by Weiss and Born (1967) who reported "disappointingly small" progress in their subject, a 7-1/2 year old autistic boy. Their subject, principally because of his age, and their training materials, relational concepts and personal pronouns, seem unfortunate choices for a critical test of operant speech training. In addition, the boy sometimes did engage in appropriate speech, for example answering novel questions, indicating a lack of stimulus and reinforcement control, rather than a lack of speech, per se.

Analysis of Normal Speech and Language

Salzinger, et. al. (1962) have conducted operant conditioning analyses of continuous speech in normal private and public preschool children, demonstrating significant effects of reinforcement on overall rate of speech, and on rate of production of reinforced speech units, such as first person pronouns. Among their results was the demonstration of differential effects of schedules of reinforcement on extinction. Speech rates of the private school children were higher, across all conditions, than those of the public school group.

The language deficits of the children of the poor have been widely discussed. Reynolds and Risley (1968) worked in a urban poverty area

preschool with a four year old girl who displayed very little verbal behavior. After a 129 day baseline, teacher attention, including the giving of play materials, was made contingent on verbalization by the child. During this condition, verbalization rose from the baseline mean of 11 percent to a mean of 46 percent. Teacher attention of the same frequency was then put on a DRO schedule (Differential reinforcement of other behaviors), and verbalization dropped to 6 percent. Contingent teacher attention, even at substantially lower frequencies, again maintained verbalization at 51 percent. The authors noted that the component of teacher attention functioning as a reinforcer appeared to be access to materials, since verbalization dropped considerably when materials were provided noncontingently.

In another study in the same setting, Hart and Risley (1968) demonstrated that a contingency involving access to materials rapidly increased the number of descriptive adjectives used by preschool children in the free play setting, an increase not obtained after learning of the adjective in a group lesson setting. Although rates of adjective use dropped somewhat when the materials contingency was removed, they remained considerably higher than after lessions alone, 12.7 versus 1.8 adjectives per child per sample hour. "There seemed to be little continuity between 'knowing' colors, as demonstrated at group time, and 'using' them in the free situation (p. 116) . . . traditional preschool methods were ineffective in modifying the children's spontaneous speech (p. 118)." Hart and Risley conclude

that for effective teaching, preschool environments should supply "contingencies for preacademic behavior approximate to those applied to such behavior in the 'beyond-preschool' environment (p. 119)."

Analysis of Reading

Reading rate has been increased through operant conditioning by Raygor, Wark and Warren (1967). A pale green light, shining up through the reading material, was employed as a noninterfering reinforcer. The light was contingent on an increasing rate, by the college student subjects, of lever pulls which exposed new material. Subjects given no reinforcement displayed steady, uniform rates. Increasing rates were seen in subjects shaped with the light reinforcer. Random presentation of the light to some subjects would have strengthened the design of this experiment.

The most extensive behavioral analysis of reading had been attempted by A. W. Staats and his associates. Textual responses, as verbal operants under the control of visual stimuli, were acquired by four year old children in an initial study (Staats, Staats, Schutz & Wolf, 1962) in which continuous reinforcement was supplied in the form of trinkets and edibles. Subsequently, a token reinforcement system, providing both immediate trinkets and edibles, and also delayed toy backups, was found better able to sustain continued performance (Staats, Finley, Minke & Wolf, 1964).

Using this system, young children have acquired verbal matching responses (Staats, Minke, Finley, Wolf & Brooks, 1964), picture matching, word matching, and textual responses (Staats, et. al., 1962), as well as unit reading responses (Staats, Finley, Minke & Wolf, 1964). Hewett (1964) used an operant conditioning procedure to teach reading and writing to a hospitilized 13 year old autistic boy who lacked speech. The boy's interest in his environment and accessibility to social control increased as he learned to read, and to write simple phrases expressing his needs, for example, "I want school."

Evaluative meaning words were shown to have reinforcing functions by Finley and Staats (1967). Words of positive evaluative meaning functioned as positive reinforcers for lever pulling responses of junior high school children, while negatively evaluated words functioned as negative reinforcers or punishments. A number of other investigations, including several on the classical conditioning of word meaning, are summarized by Staats (1968).

Discussion

Methodological Considerations

Increasing attention is being given to problems of methodology in behavioral research, both in the laboratory (Parton & Ross, 1965; Holz & Azrin, 1966), and in field settings (Goodkin, 1967; Scott, Burton & Yarrow, 1967; Gelfand & Hartmann, 1968).

Criticisms of behavior therapy research include the need for adequate baselines, preponderance of single subject case studies, gaps in data collection, failure to employ contingency reversals, the need for yoked controls, doubtful reliability of data and need for automated recording, and the desirability of multiple versus single behavior analyses (Gelfand & Hartmann, 1968). Many of these criticisms apply to research in school settings as well. Other points that have been raised are the need for adequate follow-up (Gelfand &Hartmann, 1968; Goodkin, 1967), possible experimenter bias effects (Scott, et. al., 1967; Gelfand & Hartmann, 1968), the need for objective measurement of concomitant changes in behaviors other than those directly manipulated, and inadequate attention to stimulus control variables (Goodkin, 1967).

Tharp and Wetzel (1969) have further criticized the behavioral research literature on the following grounds: Poor reporting of training techniques used with mediators of reinforcement, e. g., parents or teachers; a lack of detailed reporting of techniques of data collection; failure to explain the rationale under which target behaviors are chosen, and the process by which this decision is made; failure to explain how and why given reinforcers are chosen; inadequate description of program maintenance, especially the consultation and supervision given; and finally, omission of exact descriptions of interaction with the target (subject).

> What is told the target about the recording procedures, the language of contingency descriptions, labeling and

> discrimination aids, selection of reinforcers, and the nature of the interaction between the therapeutic agent and and the subject all must influence the outcome. As yet these variables are neither adequately described nor experimentally evaluated (Chapter 2).

The research reports reviewed in this paper have met the methodological challenge to varying degrees. Continuing clarification of methodological problems, and a search for solutions, is essential to the development of any research area. All of the issues raised deserve critical attention from behavioral researchers, and this attention should be reported in their data. Thus for example, it is very rare to find an analysis of differences in data collected by naive and informed observers, differences found significant by Scott (1967) in a study of effects of contingent attention. The existence of naive observers has itself been questioned (Rosenthal, 1967).

On the postive side, the effects of interest in behavioral research are often quite large, and this is increasingly true as the research moves toward an applied technology. Methodological considerations in evaluating experimental success are much greater when a small, but statistically significant effect is of interest than when the experimental result is the extinction of tantrums. However, this is not true of the interpretation of the experimental results. The extensive replication which follows reports of successful solutions of applied problems is another safeguard against methodological artifacts. Nevertheless, continued

progress in behavioral research will require increasingly innovative and objective attention to methodology.

Implications for Education

Programmed instruction. Johnson (1968) states that "in the past, educators have found that it takes from twenty-five to seventy-five years for a new educational concept or innovation to filter from the minds of the originators into actual teaching practice (p. 457)." Referring to the rapid adoption of programmed learning and operant methods in special education, Johnson speculates that the pace of such change is accelerating. Programmed instruction, or computerized education, is considered essential by Asbell (1968). Asbell notes that even in the "best" suburban schools, 20 percent of the children fail to master basic reading and arithmetic skills, and in the inner city schools this figure rises to 80 percent. Behavioral research is providing information on systems of motivation which can initially shape and later maximize the interaction of children with programmed instruction.

We know very little about the limits of the learning abilities of preschool children. Homme, C'deBaca, Cottingham and Homme (1968) point out that once a child can respond discriminatively to objects, that is to label them, he is in effect "reading" them. Contingency management can produce sustained performances on programmed materials, for example reading materials, by very young children.

Classroom management. Contingency management in the classroom has two principal advantages: (a) the amelioration of behavior problems, and with it a decrease in the present reliance on aversive control, and (b) the individualization of curricula and experiences for children in the school environment.

Reinforcement theory, then, can add substance to the somewhat mysterious teaching and learning process. It gives the teacher some principles with which she can use existing resources more efficiently. It does not, however, remove the need for sensitive assessment of an individual's experience in a particular situation . . . (or) concern with all aspects of his development (Scott, et. al., 1967, p. 62)."

Johnson (1968) also stresses that greater individuation results from an operant approach. He sees the role of the teacher as that of a professional learning engineer who evaluates and plans a program for each child.

Imaginative use is being made of reinforcement principles by teachers who adapt them to their own needs and styles, for example Keller's (1968) self-paced introductory college psychology course, and Levin's (1967) "peek-a-boos" for rewarding first grade beginning readers.

Teacher training. The development of effective methods of training teachers in applied operant technology is prerequisite to its effective use in the schools. Goodwin (1966) found no consistent change in the

behavior of seven teachers taught reinforcement principles and their application, nor did he find any stable increase in on-task behaviors of target children in the classrooms. While they uniformly expressed approval of the methods taught them, the teachers failed to use them effectively. In fact, one result may have been a more intermittent schedule of reinforcement for undesired behaviors.

Quay, Wherry, McQueen and Sprague (1966) suggest that mental health professionals supervise teachers in the use of behavior modification in individual cases. In addition, these authors propose special classrooms for behaviorally deviant children to be established in every school, or in several schools throughout a community. These classrooms would also serve as research laboratories to develop "techniques for teaching adaptive behavior in a group setting (p. 515)," and as demonstration and training facilities for teachers.

Effective methods of teacher training include the cueing procedure described by Hall, et. al. (1968), and frequent feedback, discussion, and review of the data during ongoing research (Madsen, et. al., 1968). As pointed out by Leff (1967), reinforcement principles are easily communicated and can be administered successfully by nonprofessionals in behavior therapy situations. Effective programs of teacher training are not widely available at present, however.

Values

The designation of behaviors as desirable or undesirable, and the choice of reinforcers to be used, presents questions of values. Goodkin (1967) cautions that the total environmental situation, not simply the target behavior, should properly concern the behavior modifier. As an example, candy reinforcement and contingent play periods greatly increased classroom attention and on-task behaviors in a six-year-old boy, who previously did little work and was highly inattentive and unresponsive (Kennedy & Thompson, 1967). The successful modification of the target behaviors is diminished, however, by the author's observation that in spite of his behavior problems, the boy showed achievement above his grade level. It is possible that acceleration or an enrichment program might have been a more adaptive solution for this child, than the establishment of attention and working at materials which might have been simply boring him.

Summing up several years of behavioral research, Tharp and Wetzel (1969) comment as follows:

> In retrospect, as we examine our participation in implementing some goals of the school, we are not altogether comfortable with participating in such educational practices as requiring silence, in-seat behavior, and tedious workbook assignments. In our view a truly educational environment provides multiple opportunities for action which leads to outcomes of maximum relevance for the learner . . . What compromises should we make for the sake of those individual children for whom the current system is the only alternative (Chapter 9)?"

Homme, et. al. (1968) speak of programming children's environments to produce joy and love. The decision that children should be joyful and loving must be made outside of the contingency manager's shop. The manipulation of contingencies to change behavior may spotlight these values judgments, and open wider discussion of what kinds of behaviors the society wants children to acquire. We shall be confronted by the task of more clearly defining what these social target behaviors are, and we shall be more clearly able to assign and assume responsibility, both in making these decisions and in implementing them.

Conclusion

Behavioral research is still fairly new and still profits from the enthusiasm and excitement attendant to new ventures. In its extension into practical social problem areas it will meet the test of usefulness. Whether a view of human behavior such as Skinner's (1953) gains in acceptance will depend largely on its technological utility in the present and future.

Whether behavioral research can make substantial contributions to the overall alleviation of current problems in education remains to be seen. On the basis of such research, a behavioral technology is developing. Its value in behavior modification is well established, and its ability to function powerfully in complex social situations has had

several promising demonstrations. The behavioral approach to an analysis of speech and reading continues to generate provocative results.

According to MacLuhan and Fiore (1967) there are more educational opportunities for children in the twentieth century outside of the classroom than inside it. The need to teach efficiently whatever must be taught, and to create learning environments in which children develop on positive schedules of internally and externally generated reinforcers, is very much a present need. Behavioral researchers are optimistic that their work will help to meet this need.

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